# COMMENTS OF ROBERT J. HALSTEAD ON BEHALF OF THE STATE OF NEVADA AGENCY FOR NUCLEAR PROJECTS REGARDING THE U.S. NUCLEAR REGULATORY COMMISSION STUDY ASSESSING RISKS OF SPENT NUCLEAR FUEL TRANSPORTATION ACCIDENTS (MODAL STUDY UPDATE)

## PRESENTED AT THE PUBLIC MEETING IN HENDERSON, NEVADA DECEMBER 8, 1999

### PHYSICAL TESTING AND COMPUTER SIMULATION

1. Nevada will continue to pursue full-scale regulatory physical testing of new shipping casks as a requirement for NRC certification and/or DOE procurement

2. Nevada believes issue of full scale physical testing of casks should be addressed in a venue separate from the Modal Study Update

3. Modal Study Update should include physical testing of critical cask components

a. Truck Cask - GA 4: closure bolts and seals (impact and fire, full scale), depleted uranium gamma shield fittings and welds (impact, fire, puncture, full scale or ½ scale), and cask tie-down systems (impact, full scale or ½ scale)

b. Large Rail Cask - TBD (e.g., MPC, NAC/ST, HiStar): closure bolts and seals (impact and fire, full scale), gamma shield (lead, lead/DU, cast iron) interface, fittings and welds (impact, fire, puncture, full scale or ½ scale), and cask tie-down systems (impact, full scale or ½ scale)

4. Modal Study Update should include computer simulations to determine GA-4 truck cask performance under extremely severe accident conditions and to determine failure thresholds for severe fire and impacts

5. Modal Study Update should include computer simulations to determine large rail cask performance under extremely severe accident conditions and to determine failure thresholds for severe fire and impacts

### HIGHWAY AND RAILWAY ACCIDENTS

1. Modal Study Update should evaluate historical accidents which created conditions that challenge the NRC cask performance standards:

a. Catastrophic highway infrastructure accidents, including:
June 29, 1983, Greenwich, CT, I-95: Collapse of Mianus River Bridge
March 5, 1985, Waynesville, NC, I-40: Massive rock slide onto highway and tunnel
April 5, 1987, Amsterdam, NY, I-90: Collapse of Schoharie Creek Bridge
July 14, 1988, Burley, ID, I-84:Support impact and overpass collapse
Oct. 17, 1989, Oakland, CA, Nimitz Freeway: Elevated Highway Collapse (earthquake)

b. Truck and rail accidents involving military explosives, including:
April 28, 1973, Roseville, CA, Southern Pacific: Explosion of 18 boxcars
May 24, 1973, Benson, AZ, Southern Pacific: Explosion of 12 boxcars
Aug. 4, 1985, Checotah, OK, I-40: Truck explosion
Nov. 21, 1990, Goldfield, NV, US 95:Truck explosion

c. Highway accidents involving impact and fire/explosion, including:
Dec. 23, 1988, Memphis, TN, I-240: Collision and explosion, propane tanker
May 20, 1991, Bronx, NY: Collision and explosion, gasoline tanker
July 24, 1998, Valdese, NC, I-40: Bridge support impact and fire, gasoline tanker

d. Railway accidents involving high speed impact and/or fire, including:
July 8, 1986, Miamisburg, OH, CSXT: Derailment and fire, multiple chemicals
Feb. 2, 1989, Helena, MT, MT Rail: Derailment and explosion, multiple chemicals
Feb. 26-28, 1989, Akron, OH, CSXT: Derailment and fire, butane tankers
May 12-25, 1989, San Bernardino, CA, Southern Pacific: Derailment, pipeline explosion
July 22-24, 1989, Freeland, MI, CSXT: Derailment and fire, multiple chemicals
Dec. 14, 1994, Cajon Pass, CA, Santa Fe: Collision
Feb. 1, 1996, Cajon Pass, CA, BNSF: Derailment and fire
Feb. 21, 1996, Leadville, CO, Southern Pacific: Derailment and spill, sulfuric acid
Mar. 4-22, 1996, Weyauwega, WI, Wisconsin Central: Derailment and fire, propane tankers

2. Modal Study Update should develop a bounding approach to accident probability which considers:

a. State specific data for most heavily impacted states

b. Route specific data for most likely national routes: I-80, Buffalo - Sacramento; I-70, Baltimore - Cove Fort; I-40, Asheville - Barstow; I-15, SLC - Barstow, US 95, Las Vegas - Tonopah; UP/SP, Chicago-Gibbon-Oakland; UP/SP, St. Louis-Gibbon-SLC-Los Angeles; BNSF, Kansas City-San Bernardino

c. Range of statistical measures to reflect year-to-year variations

d. Actual accident/incident rates for historical U.S. SNF shipments (Truck - 0.7/10.5 per million shipment-miles, Rail - 9.7/19.4 per million shipment-miles, 1970-1990, SAIC,1991)

3. Nevada is currently evaluating historical severe accidents to determine maximum credible events as part of review of DOE YM DEIS. DOE contractor report suggests 1939 Harney, NV rail sabotage incident which caused train to derail at full-speed into deep canyon. DOE YM EA (1986) acknowledged potential for military aircraft carrying live munitions bombing or crashing into rail or truck shipment. Given inherent large uncertainties in PRA, Modal Study Update should analyze accidents with probabilities at least as low as 1 in 10 million per year.

4. Probability of undetected defects and improper loading must be

evaluated both as accident-initiating and as consequence-exacerbating factors.

5. Nevada advocates use of dedicated trains and special safety protocols to reduce rail accident probability and consequence. However, Modal Study Update should not consider dedicated trains and administrative controls because:

a. DOE and nuclear industry oppose mandatory use of dedicated trains;

b. DOE YM DEIS assumes use of general rail freight service;

c. Eastern and Western railroads have different opinions regarding maximum speeds (35 mph versus 55 mph); and

d. Dedicated trains can have accidents (TMI shipment in St. Louis)

**CONTAINER PERFORMANCE DURING COLLISIONS AND FIRES**

1. Modal Study Update must select appropriate casks for analysis: Truck, GA-4 and NAC LWT; Rail - Large MPC, NAC S/T, Hi-Star, although IF-300 will probably see continued use. Several rail casks must be evaluated to address different gamma shield materials and configurations (lead, lead/DU, cast iron).

2. Modal Study Update must develop method of translating maximum credible real world impacts in comparison to regulatory drop onto unyielding surface. Examples: Rail cask 90 mph impact with rock face, bridge support column, oncoming locomotive, or another large rail cask; Truck cask 75 mph impact with rock face, bridge support column, another tractor, etc.

3. Modal Study Update must analyze cask performance in engulfing fire conditions for longer durations and higher temperatures than NRC standards require, to address potential for maximum credible real world fires. Truck cask should analyzed for 1475 degree fire for 8 hours, and 2000 degree fire for 4 hours. Rail cask should be analyzed for 1475 degree fire for 24 hours, and 2000 degree fire for 12 hours.

4. Modal Study Update must consider heat generated by SNF during fire as factor in SNF oxidation. SNF heat is probably an important factor in performance of 5-year to 10-year cooled fuel, and may be factor in seal performance for truck cask carrying 5-year cooled fuel.

**SPENT NUCLEAR FUEL ASSEMBLY BEHAVIOR IN ACCIDENT**

1. Modal Study Update must select appropriate SNF types for bounding analysis of radiological consequences of both loss of shielding and loss of containment accidents. Greatest radiological risk involves shipment of 5-year cooled, high-burnup PWR fuel (5.0 percent U-235 initial enrichment, 62,000 MWd/MTU burnup, as allowed under NRC Final Rule in 10CFR51). Moderate radiological risk would result from shipment of 26-year cooled, medium-burnup PWR fuel (3.7 percent U-235 initial enrichment, 39,600 Mwd/MTHM, as assumed by DOE in YM DEIS).

2. Modal Study Update must assume complete cladding failure and oxidation in most severe loss of containment accident. Both normal SNF and failed/degraded SNF(including core debris) must be considered in all accident scenarios. Failed/degraded fuel (including core debris) should be assumed to be containerized before shipment, and the container should be credited in boundary calculations.

3. Nevada is evaluating issue of dual-purpose cask container boundary credit.

4. Only way to gain useable knowledge about SNF behavior under extreme conditions is to test real SNF rods and pellets. Actual SNF should be tested to gain understanding of burst/rupture and fracture characteristics. Particle size distribution is a major uncertainty in modeling loss of containment accident release and dispersion.

**OTHER TRANSPORTATION SAFETY ISSUES**

1. Questionable justification of PRA approach based on historical data, when future shipment numbers and shipment characteristics, based on analysis of DOE YM DEIS and other DOE program documents, are radically different from past shipping campaigns.

2. Need for PRA to consider policy and program issues relevant to safety, such as future Congressional funding for infrastructure maintenance, NTSB safety analysis and USDOT safety inspections; DOE proposal for privatization of transportation services under fixed-cost contracts; and utility interpretation of standard contracts allowing abandonment of commitment to ship oldest fuel first (OFF).

3. Need for comprehensive human factors assessment, including human factors issues relevant to particular cask/transporter systems such as the GA-4. Issues include both driver performance and tractor/trailer performance under anticipated real world conditions, e.g. very long distance hauls cross-country and challenging driving conditions due to Western states road and weather conditions.